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4th ANSA & μETA INTERNATIONAL CONFERENCE

PROGRAMME & ABSTRACTS

4th ANSA & µETA INTERNATIONAL CONFERENCE

June 1-3, 2011, Makedonia Palace, Thessaloniki, Greece

PROGRAMME & ABSTRACTS

BETA CAE Systems SA

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Welcome

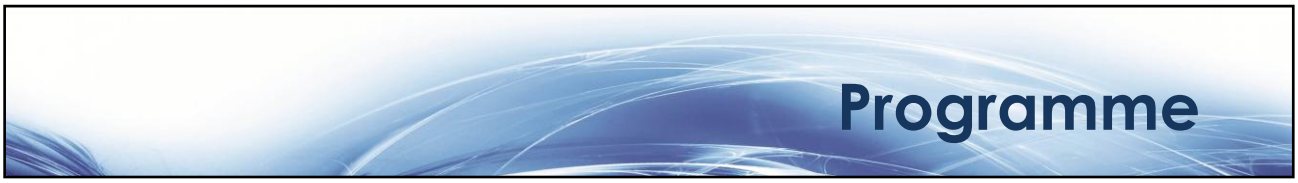
Dear Attendees

We have the pleasure and the honour to welcome you to the "4th ANSA & µETA International Conference". This year, we chose to host you in the best-in-class venue in the historic city of Thessaloniki.
Being consistent to our biannual appointment, we are offering an extended agenda of three days with selected contributions from our customers and partners, along with carefully selected topics prepared by the engineers of our company.

Along with the technical presentations, you will have the opportunity to interact with the engineers from the services and development divisions of BETA CAE Systems, to share with them your experiences, describe your problems and questions and get answers from the experts on each domain.
We reviewed carefully the feedback from the participants of our previous events and we tried to make sure that all organizational aspects will meet your expectations.

We are certain that you will enjoy both the technical and social parts of the conference.
Please, feel free to contact us for any issue regarding your stay and we will do all we can to assist you. Enjoy your participation to our event and your stay in Thessaloniki.
Thank you for your attendance and looking forward to hosting you again.

BETA CAE Systems S.A.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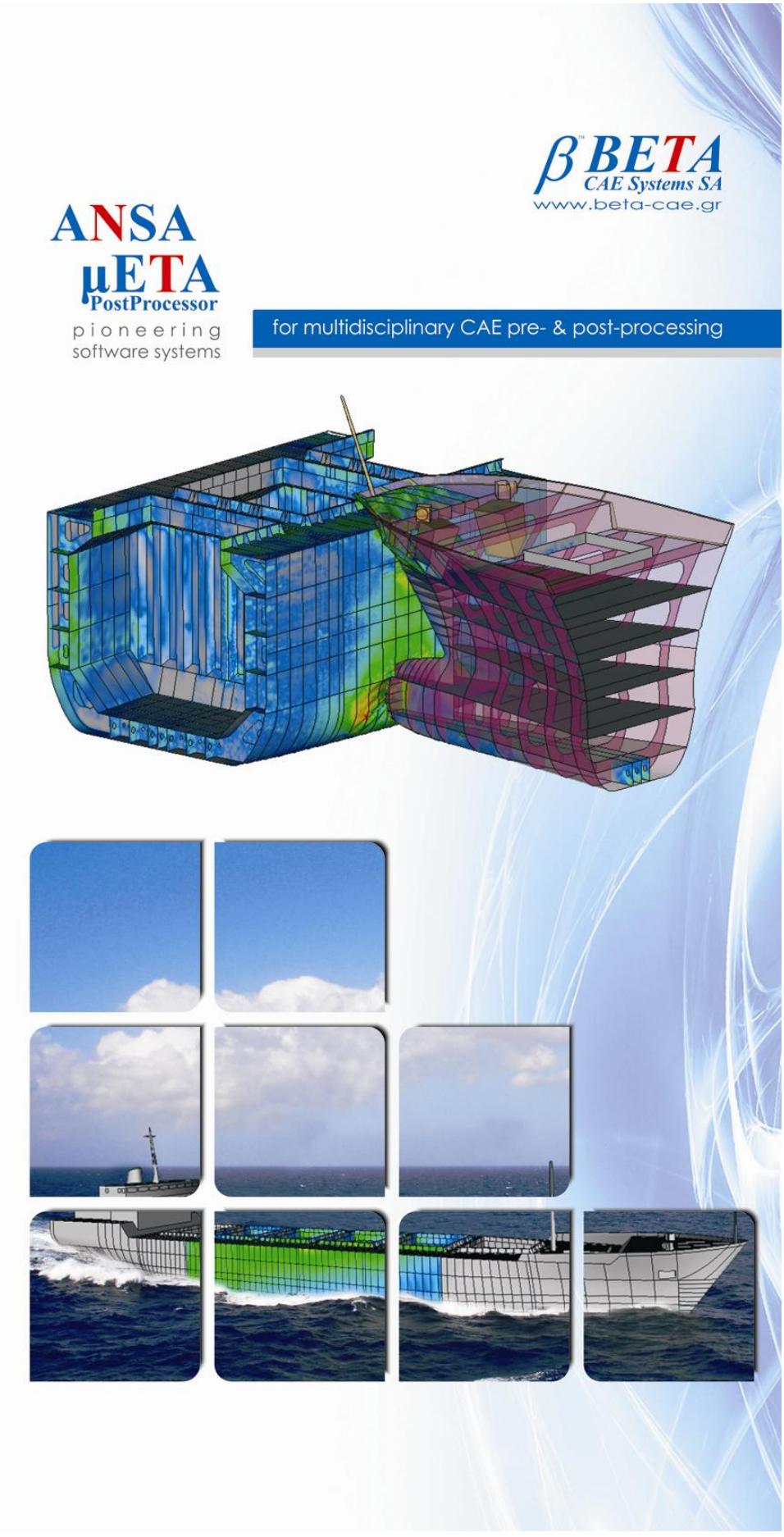
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Tuesday, May 31

16:30 - 18:30	**Pre-Registration**, Macedonia Palace Hotel Lobby
20:00 - 22:00	**Welcome Reception**, Yacht Restaurant

Wednesday, June 1

8:30 - 9:00	**Registration**, Macedonia Palace Hotel Lobby	
	Session 1, Alexandros I chair: C. Sferidou	
9:00 - 9:30	**Opening Speech** D. Angelis, President BETA CAE Systems S.A., Greece	
9:30 - 10:00	**Latest developments in ANSA** K. Kiouptsidis BETA CAE Systems S.A., Greece	
10:00 - 10:30	**Latest developments in µETA** S. Chatziangelidis BETA CAE Systems S.A., Greece	
10:30 - 11:00	**Coffee Break**	
	Session 2A, Alexandros I chair: Y. Kolokythas	**Session.2B**, Alexandros II chair: K. Haliskos
11:00 - 11:30	**Impact analysis of a cellular phone** W. Liu, H. Li, presented by H. Xing▲ Beijing FEAonline Technology Co., Ltd, PR China	**Automation and optimization - ANSA an essential aid** M. Christiansson FS Dynamics Sweden AB, Sweden
11:30 - 12:00	**ANSA and µETA Post contribution to the study of Safran Open 60' race yacht crashworthiness** P. Biagi SAFRAN Engineering Services, France	**Cavitation simulation and experimental verification using a new Diesel nozzle design concept** N. Mitroglou▲, M. Gavaises, A. Theodorakakos City University London, UK
12:00 - 12:30	**Simulation of Rail Roll and Track Buckling using LS-DYNA and ANSA** D. P. Malone[1]▲, D. Krueger[1], D. Lokesha[2], J. Weage[2] [1]TUV Rheinland Rail Sciences, Inc., USA [2]BETA CAE Systems USA Inc., USA	**ANSA evolution and contribution to the success of industry's CFD simulations** V. Skaperdas BETA CAE Systems S.A., Greece
12:30 - 13:00	**Process development for multi-disciplinary spot weld optimization with CAx-LoCo, LS-OPT and ANSA** G. Geißler[1]▲, T. Hahn2 [1]DYNAmore GmbH, Germany [2]Audi AG, Germany	**Design and analysis of a light cargo UAV prototype** A. P. Kovanis[1]▲, J. A. Ekaterinaris[1], V. Skaperdas[2] [1]University of Patras, Greece [2]BETA CAE Systems S.A., Greece
13:00 - 14:30	**Lunch**, Aristotelis	
	Session 3A, Alexandros I chair: K. Kiouptsidis	**Session.3B**, Alexandros II chair: V. Skaperdas
14:30 - 15:00	**A Strategy for standardization and automation of door durability CAE analysis using ANSA Task Manager** D. James[1], S. Patil[2]▲ [1]Chrysler Group LLC, USA [2]BETA CAE Systems USA Inc., USA	**CFD optimization via sensitivity-based shape morphing** C. Othmer[1], E. Papoutsis[2]▲, K. Haliskos[3] [1]Volkswagen AG, Germany [2]National Technical University of Athens, Greece [3]BETA CAE Systems S.A., Greece
15:00 - 15:30	**How to assess BIW structures from the fatigue point of view** M. Kaltenböck▲, H. Dannbauer, W. Hübsch, K. Puchner, S. Fischmeister MAGNA POWERTRAIN Engineering Center Steyr GmbH & Co KG (ECS), Austria	**CFD simulations of flow over NASA Trap Wing Model** A. Luo[1]▲, P. Peddiraju[2], V. Skaperdas[3] [1]Swift Engineering Inc., USA [2]BETA CAE Systems USA Inc., USA [3]BETA CAE Systems S.A., Greece
15:30 - 16:00	**Coffee Break**	
	Session 4A, Alexandros I chair: N. Drivakos	**Session 4B**, Alexandros II chair: E. Chatzivasiloglou
16:00 - 16:30	**Spot weld modeling for vehicle durability performance with ANSA** Y. Baik Renault Samsung Motors Co., Ltd, S. Korea	**Computational investigation of octopus arm hydrodynamics** A. Kazakidi▲, V. Vavourakis, J. A. Ekaterinaris, D. P. Tsakiris FORTH (Institute of Computer Science Foundation for Research & Technology), Greece
16:30 - 17:00	**Durability AddOns for ANSA and µETA** D. Fels Ford-Werke GmbH, Germany	**Parametric sharp edge morphing for aerodynamic shape optimization** V. Gandhi[1]▲, Robert Lietz[2], Ashutosh Patil[1], Ravi Nimbalkar[1] [1]BETA CAE Systems USA Inc., USA [2]Ford Motor Company, USA
	Session 5, Amfitrion	
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	Session 6, Alexandros I chair: V. Pavlidis	
9:00 - 9:30	**Automatic generation of XML formats report by using ANSA and µETA Post** S. Shibuya[1], R. Nishioka[1] presented by H. Okamura[2▲] [1]Honda R&D Co., Ltd., Japan [2]TOP CAE Corporation, Japan	
9:30 - 10:00	**Evaluation and visualization of equivalent radiated power in µETA** K. Wiechmann▲, J. Hiller P+Z Engineering GmbH, Germany	
10:00 - 10:30	**Performance and graphics optimization on BETA CAE Systems products** B. Coquelle, D. Ali▲ Advanced Micro Devices Ltd, USA	
10:30 - 11:00	**Coffee Break**	
	Session 7A, Alexandros I chair: S. Seitanis	**Session 7B**, Alexandros II chair: G. Korbetis
11:00 - 11:30	**ANSA & µETA integrated suite to streamline the detailed assessment of full vehicle NVH behavior** V. Pavlidis BETA CAE Systems S.A., Greece	**Extension of optimization capabilities with TOSCA, ANSA and ULTRASIM** H. Weiler▲, T. Hensel BASF SE, Germany
11:30 - 12:00	**Squeal Analysis of disc brake system** H. Xing Beijing FEAonline Technology Co., Ltd, PR China	**Development and use of an ANSA component for Isight process integration** D. Kokan[1▲], A. Dongare[2] [1]Dassault Systèmes SIMULIA Corp., USA [2]3DPLM Software Solutions, India
12:00 - 12:30	**Using ANSA for beams and shells FE concept models at BMW** M. Kroiss[1▲], H. Schneeweiß[2], L. Cremers[2] [1]IABG mbH, Germany [2]BMW Group, Germany	**Multi-objective optimization with modeFRONTIER interfaces for ANSA and mETA Post** A. Clarich▲, R. Russo, M. Carriglio ESTECO Srl, Italy
12:30 - 13:00	**Re-analysis methodologies for shape changes in NVH** Z. Mourelatos[1▲], S. Patil[2], D. Lokesha[2], J. Skarakis[2] [1]Oakland University, USA [2]BETA CAE Systems USA Inc., USA	**Utilization of morphing/sizing capabilities to optimize performance of reinforced plastic components taking into account the fiber orientation effects** M. Lambi BASF Engineering Plastics, USA
13:00 - 13:10	**Group Photo**	
13:10 - 14:30	**Lunch**, Aristotelis	
	Session 8A, Alexandros I chair: S. Chatziangelidis	**Session 8B**, Alexandros II chair: M. Tryfonidis
14:30 - 15:00	**Using ANSA for automated FE-modeling of turbocharger housings** D. Dreissig[1▲], F. Kruse[2▲] [1]LASSO Ingenieurgesellschaft mbH, Germany [2]BorgWarner Turbo Systems Engineering GmbH, Germany	**Effect of PLY Number & orientation of composite structure in bird strike analysis** Trivikram N. L.▲, M. R. Yeli, R. Venkatesan, V. R. Sural EASi Engineering, India
15:00 - 15:30	**ANSA batch meshing for CAD based vehicle concept modeling** B. Lauber ISKO engineers AG, Germany	**EMC model building using ANSA** F. Kadlček▲, P. Tobola Evektor, spol. s r. o., Czech Republic
15:30 - 16:00	**ANSA as an advanced tool in biomedical modelling and engineering** A. Tsouknidas▲, S. Savvakis, N. Michailidis, K. Anagnostidis Aristotle University of Thessaloniki, Greece	**CAE model interrogation & data mining** N. Kalargeros▲, G. Haritos University of Hertfordshire, UK
16:00 - 16:30	**Coffee Break**	
	Session 9, Amfitrion	
16:30 - 18:30	Technical discussions, demonstrations and meetings	
20:00 -	**Dinner – Social Event: "Greek Night"**, Aristotelis	

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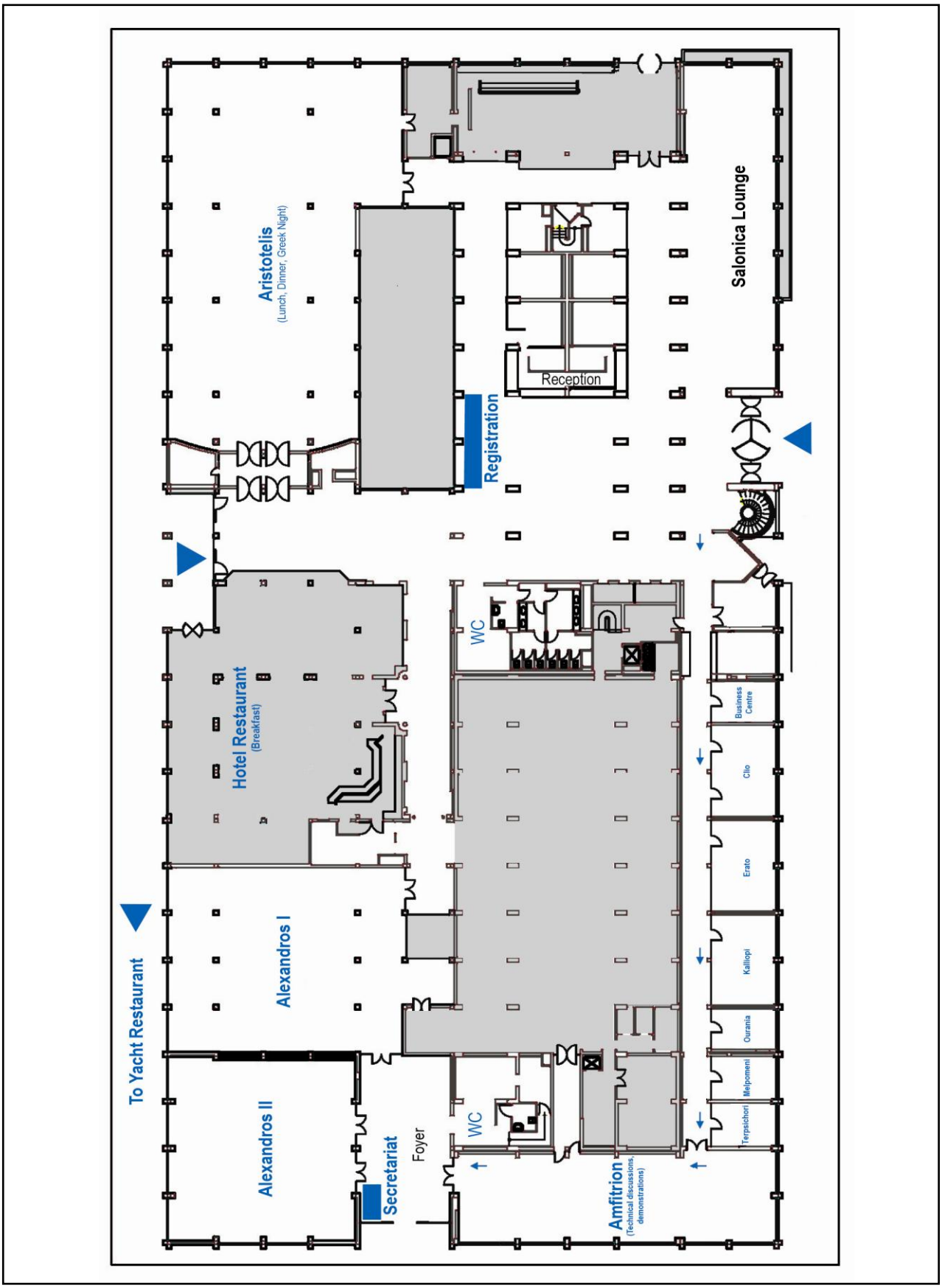
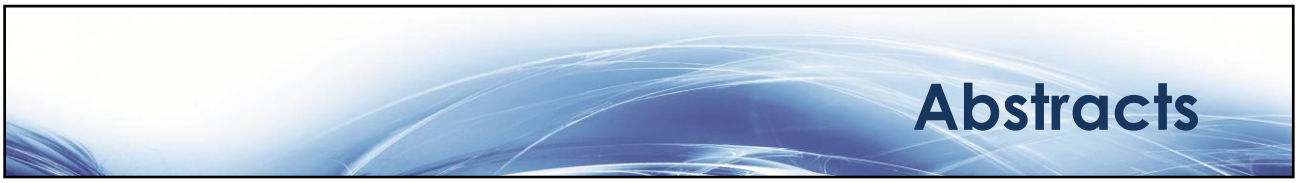
	Session 10, Alexandros I chair: I. Makropoulou
9:00 - 9:30	**Crash Simulation: Challenges and future prospects** A. Kaloudis[1]▲ H. Klamser[2] [1]BETA CAE Systems S.A., Greece [2]Dr. Ing. h.c. F. Porsche Aktiengesellschaft, Germany
9:30 - 10:00	**Vehicle level UFEA process using ANSA, Abaqus and SIMULIA scenario definition** M. Roswall▲, R. Bois, M. Schrank, Y. Choi, S. Sankar Dassault Systèmes SIMULIA Corp., USA
10:00 - 10:30	**The use of generic entities for multi-disciplinary pre-processing. A simple but powerful pattern in ANSA** Y. Kolokythas▲, L. Rorris BETA CAE Systems S.A., Greece
10:30 - 11:00	**Coffee Break**
	Session 11, Alexandros I chair: S. Saltiel
11:00 - 11:30	**CAE model build-up in collaboration with external suppliers not having direct access to the enterprise SDM environment** Z. Petrovic[1]▲, I. Charalampidis[2] [1]Siemens Industry Software GmbH & Co., Germany [2]BETA CAE Systems S.A., Greece
11:30 - 12:00	**Implementation and use of SPDRM to streamline a CAE process** S. Seitanis▲, Z. Margellou, A. Korbetis BETA CAE Systems S.A., Greece
12:00 - 12:30	**Future developments in ANSA and µETA** C. Kolovos, Vice President BETA CAE Systems S.A., Greece
12:30 - 13:00	Q&A – Closing
13:00 - 14:30	**Lunch**, Aristotelis

Venue Plan

Makedonia Palace, site map




Abstracts

Session 2A

IMPACT ANALYSIS OF A CELLULAR PHONE

Wei Liu, Hongyi Li, presented by Hao Xing▲
Beijing FEAonline Engineering Co.,Ltd. Beijing, China

ABSTRACT – Drop test simulation plays an important role in investigating impact behaviors and identifying weak points of a cellular phone at design stage since actual testing is expensive and time consuming. This paper presents the impact study of a new cell phone design with split steel bands. The finite element model of the assembly was developed by using ANSA, the state-of-the-art pre-processor, and analyzed with LS-DYNA. The unit was dropped on a granite floor from the height of 1 meter with different orientations, such as face drop, edge drop and corner drop. Focus was paid on some key components. The integrity of the split band was investigated carefully; the stresses for cover glass and LCD layers were evaluated numerically; and the shock absorbing performance of different visco-elastic pads attached on camera was compared in details.

SIMULATION OF RAIL ROLL AND TRACK BUCKLING USING LS-DYNA AND ANSA

[1]Daniel P Malone▲, [1]Darrell Krueger, [2]Deepak Lokesha, [2]Joshua Weage
[1]TUV Rheinland Rail Sciences, Inc, USA, [2]BETA CAE Systems USA, Inc

KEYWORDS **–** Rail Rollover, Rail Buckling, ANSA Scripting, Automation

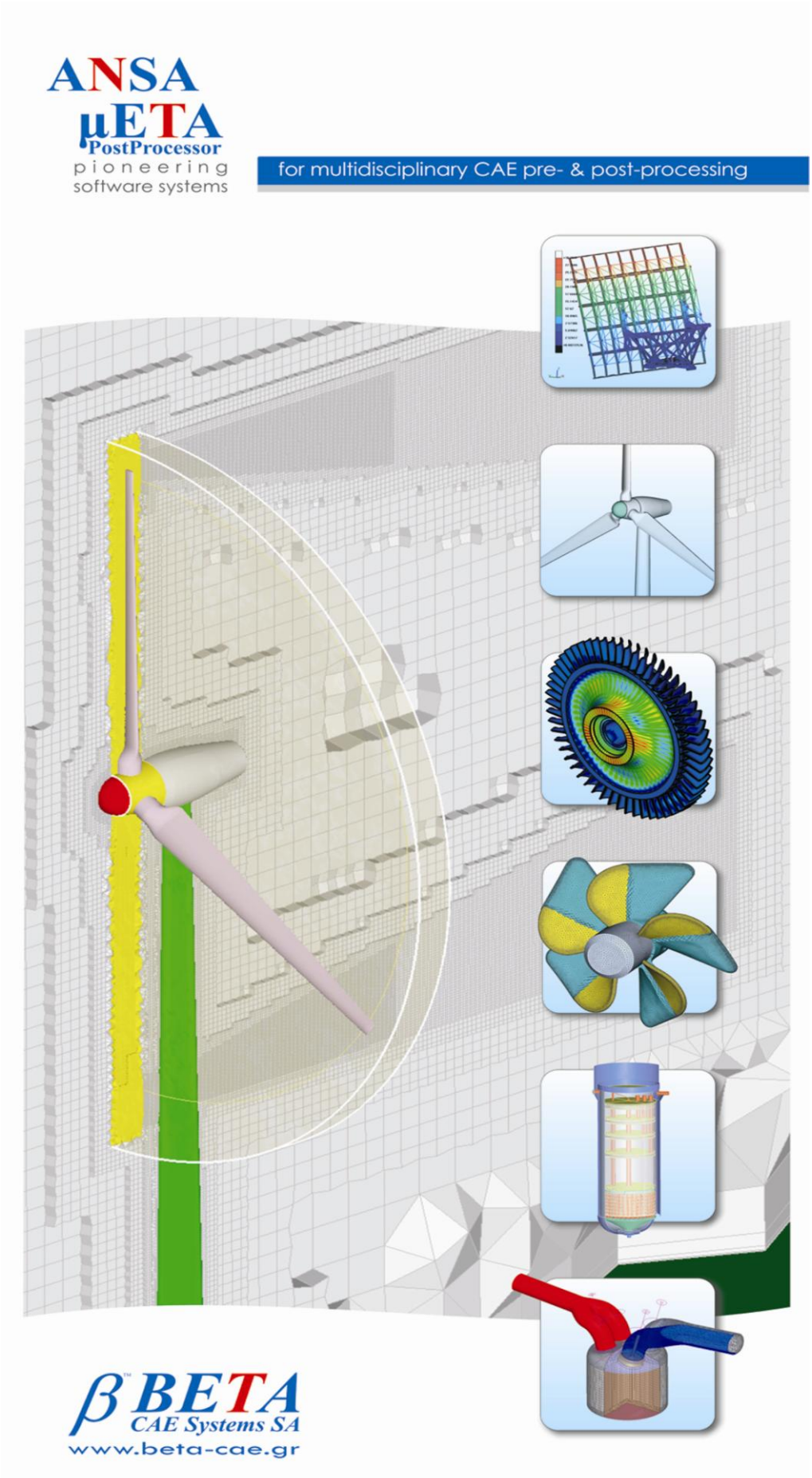
ABSTRACT – Rail rollover and track buckling are not well-understood phenomena that continue to cause derailments each year costing the industry millions of dollars. Cost effective maintenance and design solutions are needed but up until now, there has been no systematic way to evaluate potential solutions or to understand the influence of contributing factors in a track incident. The many influencing factors such as track condition, track curvature, rail restraint, rail wheel interaction, rail wear, thermal stress and many other factors that contribute to rail rollover and track buckling have not been systematically and parametrically studied. Limitations due to simulation software capability, the cost of model creation and available computer power have historically hindered these efforts. Today's advanced simulation software along with the dramatic decrease in the cost of computational power has made doing such a study practical. Building such detailed and extensive track models have historically been labour intensive as well as computationally expensive. This paper will discuss the complete automation of the creation of a detailed three dimensional finite element model of a section of track that includes rail curvature, spikes, tie plates, ties, wheel rail interaction and ballast stiffness. An ANSA script accomplishes a complete modular and parametric model build. The wheelsets load the rail vertically and laterally. The application of thermal stress is optional. Preliminary findings are presented.

PROCESS DEVELOPMENT FOR MULTI-DISCIPLINARY SPOT WELD OPTIMIZATION WITH CAX-LOCO, LS-OPT AND ANSA

[1]Dr. Gordon Geißler▲, [2]Thomas Hahn
[1]DYNAmore GmbH, Germany, [2]Audi AG, Germany

KEYWORDS – Connection Modelling, Process Integration, Optimization, SDM

ABSTRACT – The number of connection entities in modern car constructions is growing continuously. From that point of view, the identification of the most suitable structural behaviour of various car body configurations with respect to the number and the arrangement of connections becomes a challenge in automotive development. A standard simulation and optimization process was developed and established in a common project with the Audi AG and DYNAmore GmbH. The simulation model assembly process consists of a car body without any connection entities, a structured data format that describe the connections in detail and an automated process that realizes the connections using ANSA.
All of these components are administrated and provided through the AUDI specific simulation data management tool CAx Load Case Composer (LoCo). This software is developed by DYNAmore and provides, among other innovative features, the possibility to parameterize components of the simulation model. With that ability at hand, it becomes possible to introduce parameters for the number of spot welds on a specified line. With the automated assembly process, the simulation engineer becomes able to investigate a number of spot weld configurations with a minimal amount of time and specific process knowledge.
Connecting this parameterized assembly process with a structural optimization software like LS-OPT, provides the possibility to set up a systematic investigation of spot weld configurations with respect to any simulation response representing structural performance. The reduction of the total amount of connections under consideration of constraints can be one goal of such an investigation. Also the adjustment of a desired structural stiffness or the control of the deformation behaviour by the connection setup might be possible objectives in that context.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Session 2B

AUTOMATION AND OPTIMIZATION - ANSA AN ESSENTIAL AID

Marcus Christiansson
FS Dynamics Sweden AB, Sweden

KEYWORDS – CFD, automation, automated optimization

ABSTRACT – An automated CFD process was developed for exhaust aftertreatment applications, using ANSA in combination with STAR-CCM+. The automation in ANSA consisted of simple scripts that could execute common recurring operations, and important goals were automation, robustness and repeatability. These goals were achieved, which ultimately meant lower turnaround time and better result quality.

FS Dynamics have carried out a number of automated optimization projects for varying CFD applications, and with different methods. However, a preferred approach is to combine ANSA, STAR-CCM+ and modeFRONTIER. As the optimization is based on a well-defined parameterization of the geometry ANSA's role is to take care of the geometrical modifications via parameterized morphing. Generally, the results from automated optimization are of higher quality and obtained within a shorter time frame, compared to if manual improvement work would have been carried out. Besides, wider understanding of the potentials and the robustness of the application is obtained.

CAVITATION SIMULATION AND EXPERIMENTAL VERIFICATION USING A NEW DIESEL NOZZLE DESIGN CONCEPT

Nicholas Mitroglou▲, Manolis Gavaises, Andreas Theodorakakos
School of Engineering and Mathematical Sciences, City University London, UK

KEYWORDS – ANSA, Hexa-Block, Grid Generation, Cavitation, Modelling, Diesel Injector

ABSTRACT – The onset and development of cavitation in a new Diesel injector nozzle design is investigated both computationally through use of CFD and experimentally using transparent nozzle replicas. The injector design eliminates the sac volume and isolates the flow path that links adjacent holes. It is proved that this results to elimination of vortex cavitation and profound spray stability. Unlike most existing nozzle designs, geometric cavitation becomes a controlled flow characteristic that can be used to determine fuel atomisation and near-nozzle spray angle. Modelling of cavitation is performed using various sub-models for nucleation and bubble formation, further bubble growth and collapse, as well as bubble break-up and transport are incorporated into the model. Simulations are performed both under fixed and transient needle lift conditions. Mesh generation is performed using a new feature of ANSA called Hexa-Block that allows for hexahedral meshes to be located throughout the computational domain; that is found to increase model accuracy, particularly at cases of low needle lift where distorted cells inevitably decrease numerical accuracy. Model validation is performed against experimental data performed in transparent nozzle replicas operating under steady-state flow conditions. Measurements include, in addition to nozzle discharge coefficient, images of the geometric hole cavitation at various combinations of needle lifts, Reynolds and cavitation number.

ANSA EVOLUTION AND CONTRIBUTION TO THE SUCCESS OF INDUSTRY'S CFD SIMULATIONS

Vangelis Skaperdas
BETA CAE Systems S.A., Greece

KEYWORDS – ANSA, CFD, evolution, meshing, pre-processing

ABSTRACT – Computational Fluid Dynamics has been a rapidly growing and diversifying field over the past several decades that it is hard to set a specific “birth” date. However if we focus on industrial CFD applications, as we now know them, we can place a starting period sometime in the 80s. Since that time, various sectors of the industry have invested and equally benefited from the insight that this method provides.

Some 30 years later, the industry now expects from CFD to simulate its most complex and realistic models, in a fraction of the time that was required in the past, and to offer reliable understanding for practical improvements of a product well ahead in its design process. There are three main factors that have contributed to this achievement:
- the rapid growth of computational hardware resources
- the development of accurate, robust, and user friendly CFD solvers, and
- the evolution of powerful CAD and CAE tools

In this paper we will focus on the evolution of ANSA as a pre-processor for CFD model preparation. We will see how, over the past 20 years, ANSA has grown from a geometry clean up and surface meshing software that was needed by the automotive industry, to a complete suite of tools for complex and high quality CFD model setup and management.

Based on the accumulated experience from working in close cooperation with the industry, we will present all the currently available pre-processing techniques together with their pros and cons, and we will discuss about the future development plans to overcome any remaining bottlenecks, as well as to make the most out of the opportunities that arise with open source codes.

DESIGN AND ANALYSIS OF A LIGHT CARGO UAV PROTOTYPE

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KEYWORDS –

ABSTRACT – A light cargo unmanned air vehicle (UAV) was designed, constructed, and tested in flight. This UAV was designed and build according to the specifications of the Air Cargo Challenge 2009 Design, Build & Fly European student competition. The basic aerodynamic and stability analysis that was used in the preliminary phase of the light UAV design are presented. Flight stability analysis was based on the linearized theory. The preliminary aerodynamic analysis was based on Navier-Stokes solutions for wing and wing-body configurations. The conceptual design was constructed and successfully tested. Further aerodynamic analysis for the full configuration was carried out to evaluate the performance during the flight envelope. The findings of this analysis could be utilized to further improve the aerodynamics of the existing design, and enhance stability and performance characteristics of the light cargo UAV.

Session 3A

A STRATEGY FOR STANDARDIZATION AND AUTOMATION OF DOOR DURABILITY CAE ANALYSIS USING ANSA TASK MANAGER

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KEYWORDS – Task Manager, Template, Doors, Durability, Door Slam,

ABSTRACT – to compete in the modern automotive industry with a heavy reliance on engineering analysis through cae, the cae analysis must be completed accurately and in an in increasingly efficient manner. further, an automotive company with a broad range of products and engineers working throughout the world requires analysis to be performed using standard methods for ease and clarity in communicating results and driving product decisions quickly.

Chrysler Group LLC and Beta CAE are working together to develop a suite of templates for performing door durability analysis utilizing the Ansa Task Manager. These templates are developed to automate routine tasks, reduce duplication of effort, increase quality, and facilitate standardization of the processes. Through utilization of the templates, Chrysler Group LLC expects to be able to build better quality products while getting to market faster with lower development cost.

At the heart of these templates is a standard door durability discipline model build which can be used for any door durability load case. The model is structured in a standard way by using a template for the discipline model build itself. Load case templates are then applied to the door durability discipline model to automate and standardize the load case setup. A template for door slam analysis has been completed and is in implementation stage. Templates for the remaining door durability load cases will follow later this year.

HOW TO ASSESS BIW STRUCTURES FROM THE FATIGUE POINT OF VIEW

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KEYWORDS – Fatigue, Finite Elements, FEMFAT, Seam Welds, Spot Welds

ABSTRACT – For lightweight automotive body structures, the stiffness and the fatigue behaviour is massive influenced by the properties of its joints. The used joining technology, the number and the distribution of the joints are of high importance to derive well engineered and cost effective structures.
Numerical simulations, mainly based on the Finite Element Method (FEM) were implemented in the development process to reduce mass, increase body stiffness, optimize the crash and NVH behavior as well as to derive well balanced fatigue characteristics. Beside possible shorter time to market and lower costs these quite new technologies lead to optimized usage of material and production resources.

In the area of fatigue simulation there are some necessary specifics of the FE-model to enable such kind of investigations. On the one hand the whole durability analysis process has to be quick to enable efficient variants assessments. On the other hand the various possible joining technologies (like spot welds, seam welds, adhesives, self piercing rivets, flow drills,…) with its individual behavior regarding fatigue, leads to specialized modeling necessities for each type of connection. Therefore ANSA provides several possibilities to set up a FE-mesh ready to do a subsequent fatigue assessment with the ECS software FEMFAT.

This lecture shall represent the typical process in the area of BIW fatigue assessment. Starting from load time history preparation by a combination of simplified measurement and so called “Virtual Iteration”, the specific set up and details of the FE-model and the subsequent fatigue analysis will be shown. The focus will be put on the joining technology representation in the FE-model as well as the possibilities in ANSA to optimize the respective pre-processing task.

Therefore the lecture shows how ANSA supports the engineer to derive the specialized models for spot welds as well as for seam welds. To cover the whole simulation process some more information about fatigue assessment of the different joining types will complete the picture of the process.

Session 3B

CFD OPTIMIZATION VIA SENSITIVITY-BASED SHAPE MORPHING

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KEYWORDS – CFD, Optimization, Sensitivities, Adjoint method, Morphing

ABSTRACT – Since the availability of professional adjoint CFD solvers, adjoint-based optimization methods are getting increasingly popular for industrial CFD – both for topology and shape optimization. A critical component of an adjoint-based shape optimization process chain is the translation of surface sensitivities into an improved shape. We present a novel implementation of such a translation process: Surface sensitivities, as obtained from the adjoint CFD code, are used to steer the shape morphing process in ANSA, thus giving rise to an efficient, goal-oriented shape optimization method. The mapping of surface sensitivities to morphing control points as realized within this study closes the gap persisting until now for an industrial process chain of sensitivity-based CFD optimization. The mapping technique and its technical realization within ANSA are described and demonstrated using an automotive example: the optimization of aerodynamic drag.

CFD SIMULATIONS OF FLOW OVER NASA TRAP WING MODEL

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KEYWORDS –

ABSTRACT – This presentation summarizes CFD simulations of airflow over swept, medium/high-aspect ratio wings in landing/take-off (high-lift) configurations, performed on a NASA "Trapezoidal Wing" model. Commercial CAE-processor ANSA was used for mesh generation and commercial CFD-solver CFD++ was used for CFD analyses. In this study, three test cases: 1) Grid convergence, 2) Flap deflection prediction, and 3) Turbulence model dependence, were investigated. Swept wing force, moment, flow confluence, and surface pressure values were observed through numerical simulations for the above test cases and compared with the experimental data published by NASA.

Session 4A

SPOT WELD MODELING FOR VEHICLE DURABILITY PERFORMANCE WITH ANSA

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KEYWORDS – Spot weld modeling, Fatigue life analysis, ANSA script

ABSTRACT – Spot welding is one of most widely used technique for metal sheet assembly of automotive industry. Typical BIW steel sheets are joined together by about 4,000 spot welds.
In stage of FE calculation, Spot weld FE-modeling is a trade-off between accuracy and meshing time. but pre-processing tool's improvement gives big advantage to solve this kind of problem.
Accurate CAE prediction for NVH or durability performance can be only obtained when its FE model build-up is exactly performed from CAD data with appropriate spot weld realization method.
The introduction part of this presentation overviews various realization methods of spot weld in CAE pre-processor ANSA and its feature.
Second description focuses on spot weld realization for durability which is most sensitive to fatigue life result and usually wasteful of time and resources.

DURABILITY ADD-ONS FOR ANSA AND µETA

Dr. Dietmar Fels
Ford Werke GmbH / Germany

KEYWORDS – Durability, Scripting, Pre –and Postprocessing

ABSTRACT - The functionality of ANSA and µETA has reached an outstanding level. For beginners and also for experienced users it might be difficult to keep the overview about all options for pre- and postprocessing of finite element models. However user-friendliness and efficiency can be improved by the use of customized options to generate and check models and to accelerate the postprocessing of results.

The scripting language for ANSA and µETA is a powerful tool to add user routines. Especially the huge libraries of predefined functions allow the generation of source code in an acceptable amount of time.

A collection of tools for durability and strength has been created. A first group of scripts covers the check (including fixes) of models according to company internal guidelines. The pre- and postprocessing of spot welds has been improved by several functions (for example postrealization function for thickness dependent failure criterion; calculation of failure factors in µETA; section forces, stress components and fatigue of spot welds). The link between ANSA and µETA via named entities is a key feature for an accelerated postprocessing. ANSA tasks have been prepared to generate named entities for a standard postprocessing in µETA (e.g seat belt and bolt forces, buckle and submarining angles).

A special type of result mapping has been developed for sliding door slam simulation.

Session 4B

COMPUTATIONAL INVESTIGATION OF OCTOPUS ARM HYDRODYNAMICS

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KEYWORDS –

ABSTRACT – Existed studies of bio-inspired robotic systems navigating in fluid environments have oversimplified the effects of flow in their dynamic models, and hence the generated hydrodynamic forces. Utilizing computational fluid dynamic techniques, we investigate the hydrodynamics of the octopus arm. Large size hybrid-type meshes were constructed to accurately describe the complex geometry details and for capturing complex flow features. The results obtained will be used for assisting the design of robotic octopus prototypes and of corresponding control strategies.

PARAMETRIC SHARP EDGE MORPHING FOR AERODYNAMIC SHAPE OPTIMIZATION

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KEYWORDS – CFD, Aerodynamics, Sharp edge, Morphing, ANSA

ABSTRACT – The upward spiral of fuel prices has led to an increased demand for more fuel efficient vehicles. vehicle fuel economy at highway speeds is significantly influenced by the aerodynamic drag of the vehicle. overall body shape requirements/constraints needed to create an aerodynamically efficient vehicle are well known. the real challenge to the aerodynamicist is to incorporate these aerodynamic queues into a shape that is also aesthetically pleasing and acceptable to the design studio.

Vehicle styling that incorporates highly curved rearward facing surfaces can be particularly problematic in developing an aerodynamically efficient vehicle. Attached flow accelerating around rearward facing surfaces creates areas of relatively low pressure. These low pressure areas, in turn, lead to significant increases in overall vehicle drag. These low pressure areas can be reduced or eliminated by forcing earlier separation through curvature changes to the underlying surface. These surface changes, however, are typically not acceptable from a styling perspective. Earlier flow separation can also be initiated by adding sharp edges or strakes to the original curved surface. This approach can at times be more acceptable to styling.

Defining the optimum profile, location, size, and orientation for these sharp edges is extremely challenging experimentally from both a cost and timing perspective. An analytically based approach combining feature (sharp edge) creation, morphing technologies and computational fluid dynamic simulation is a viable alternative.

In this paper, we show how sharp edge features can be introduced and how their shapes and sizes can be parametrically controlled to find the optimum shapes using ANSA morphing capabilities. The paper also describes a process where the template of parameterization for shape optimization can be applied repetitively to different vehicles. The template containing the morphing boxes, optimization task, and related scripts is created in the base ANSA model and the whole setup is carried to different vehicles.

Session 6

AUTOMATIC GENERATION OF XML FORMATS REPORT BY USING ANSA AND META POST

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KEYWORDS – Automatic Generation of XML Formats Report
Reduction of report making time
Reduction of Human Error,
Application to vehicle development
Effective use of data and resource

ABSTRACT – Recently, reduction of development times by No Prototype Car has increased the importance of CAE. As a result, the number of evaluation components by using CAE analysis has increased. Therefore, an increase of the modelling and the reporting time becomes a big problem. In addition, an increase of human error of the modelling and the reporting because of an increase of CAE analyst becomes a big problem.
To solve these problems, we developed an automatic report generator to generate the Power Point report by using ANSA and µETA Post.
This report generator outputs the PPTX report corresponding to Open XML Formats automatically. This system automatically generates the report not only for the output of result but also for the output of the model information for checking model. As a result, a human error has been reduced. In addition, the generating time of one report was shortened from 720 minutes (Manual operation) to 20 minutes (Server execution).
In addition, the report generation that used the grid computing can be executed because the server execution is possible, and the resource can be used effectively.
In this presentation, we introduce the application experience to the durability evaluation analysis of the door model, and the development plan in the future.

EVALUATION AND VISUALIZATION OF EQUIVALENT RADIATED POWER IN μETA

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KEYWORDS – ERP, Noise, Vibration, NVH

ABSTRACT – Noise and vibration control is a demanding task in many engineering applications such as automotive engineering. Computation of the equivalent radiated power (ERP) is a simplified method to gaining information about maximal possible dynamic radiation of components and panels for specific excitations in frequency response analysis. ERP is well established and widely used. Integrated ERP computation with commercial solvers as a downstream process to evaluation of velocity responses is still limited. Only a limited number of commercial NVH post processing tools offer the possibility to compute and visualize ERPs from velocity results. Recent releases of μETA do not have this feature.
The authors have implemented and tested a new toolbar for ERP computation and visualization in μETA taking advantage of the improved scripting functionality and the toolbar designer in recent releases of μETA. Implementation, functionality, limitations and possible extensions of the ERP toolbar are explained and discussed in detail. Examples from automotive applications like validation and optimization of a gearbox are presented. Results derived with the ERP toolbar are compared with those derived with the ERP functionality of MD Nastran 2010. There is a good agreement of the results.

PERFORMANCE AND GRAPHICS OPTIMIZATION ON BETA CAE PRODUCTS

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Advanced Micro Devices Ltd, USA

KEYWORDS – Graphics performance

ABSTRACT – We will describe how BETA CAE Systems S.A. and AMD improved ANSA rendering engine by using new technology.

Session 7A

ANSA & META INTEGRATED SUITE TO STREAMLINE THE DETAILED ASSESSMENT OF FULL VEHICLE NVH BEHAVIOR

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KEYWORDS – Dynamic response, FRF assembly, reduced model

ABSTRACT – Conducting NVH analysis, especially for large models, is a complicated process that imposes hard requirements on pre / post processing as well as on solving itself. The main difficulties that should be overcome are related to the vast amount of data that are created, the long processing / solving times and the complicated procedures involved, such as the creation of reduced models, which make the whole process more prone to errors.

To address these needs, BETA CAE Systems S.A. is developing a unified console for driving all NVH analyses. This tool (embedded in ANSA) features a simplified diagram view where all components and connectors among them are depicted and can be directly accessed. All NVH actions can be driven from within this environment. Each of the components of an assembly can acquire a reduced representation (binary or ASCII modal models for all or just few selected degrees of freedom, test-based FRFs as well as calculated FRFs). The creation of these representations is streamlined and takes place in the background. Other types of components such as simplified rigid bodies and beam stiffeners are also supported. After the components are all set, various loadcases can be easily defined or even invoked from a library with saved loadcases. All information is then passed to µETA in the background which is driven to conduct an FRF based analysis for the calculation of the dynamic responses (including acoustic responses, modal participations, panel participations). Several "what-if" studies can be conducted in a fast and simple way and the tool assures that errors due to the complicated nature of NVH analysis are avoided. Streamlining of the whole process can be further augmented by the use of ANSA DM (ANSA Data Management). More features such as TPA (Transfer Path Analysis), calculation of connectors sensitivity and connectors forces are under development and will soon become available.

SQUEAL ANALYSIS OF DISC BRAKE SYSTEM

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KEYWORDS – disc brake, squeal, ABAQUS, ANSA

ABSTRACT – Squeal analysis of disc brake system continues to be a challenging issue in both industrial and academia due to its complexity and frequent occurrence. Thanks to rapid development of computational device and commercial software, finite element analysis becomes much more efficient and dominates the methods of analysis. Currently, two major FEA approaches are used in general, the transient analysis and complex modal analysis. Complex modal analysis studies the stability of the steady state system under small perturbation; if the vibration amplitude blows up, squeal may occur. Transient analysis is capable to study the vibration of the system during whole braking process. Frequencies of squeal are then calculated from Fourier transform. Particularly, nonlinearity, such as thermodynamic and wear effects could be included. In our case, a disc brake system for passenger car is modelled and analysed using both approaches. We use ANSA/META as pre/postprocessor and ABAQUS as solver. Furthermore, thermal effect is included in transient analysis. Results are compared and analysed in detail.

USING ANSA FOR BEAMS AND SHELLS FE CONCEPT MODELS AT BMW

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KEYWORDS – ANSA, Nastran, Optimization, Concept modeling, NVH.

ABSTRACT – Car body development and optimization in early concept phases using beams and shells FE models is a well-established process at the BMW NVH department. The goal for these concept investigations consists of providing mainly qualitative answers for the full vehicle concept regarding prescribed functional targets, in particular for vibrations and acoustic comfort. Weight reduction and construction space potential is to be revealed and various concept variation investigations are to be performed.
When using beams and shells FE models the vehicle model is not defined in an exact geometrical way, but based on functional topological aspects divided into beams and plate structures. Different standard load cases for car body design and optimization have been defined based on detailed analysis of a series of customer relevant full vehicle functional performance targets with respect to vibration and acoustic comfort. The optimization model is completed by the definition of a target function, seeking an optimal car body structure within the feasible design space, satisfying all requirements and constraints of all specified load cases for minimal total car body weight.
In the course of switching from simple Nastran beam library profiles to PBxSECT profiles that allow an exact geometric definition of the beam cross section, ANSA has been established as “state-of-the-art” pre-processor for modelling these beam shell models. ANSA is enhanced by various User Scripts to leverage the existing process in terms of rapidness, efficiency and quality.
The paper provides an overview of the current process focused on the modelling aspects performed in Ansa, illustrated by an application case.

RE-ANALYSIS METHODOLOGIES FOR SHAPE CHANGES IN NVH

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KEYWORDS – Design optimization, NVH, vibration, re-analysis, reduced-order modelling

ABSTRACT – Finite-element (FE) analysis is a well-established methodology in structural dynamics. However, optimization studies can be prohibitively expensive because they require repeated FE analyses of large models. Various re-analysis methods have been proposed for gauge (e.g. thickness) changes with the premise to effectively calculate the dynamic response of a structure after a baseline design has been modified, without recalculating the new response. The parametric reduced-order modelling (PROM) and the combined approximations (CA) are two re-analysis methods, which can handle large model parameter changes in a relatively efficient manner. However, they can not efficiently handle large FE models with a large number of degrees of freedom (DOF) and a large number of design parameters, which are common in practice. For this reason, a modified CA (MCA) has been developed. In previous conferences, we have presented the advantages and disadvantages of the PROM, CA and MCA methods for only gauge changes. In this paper, we discuss the performance of the re-analysis methods for NVH problems with shape changes. A realistic vehicle finite-element model will be used to demonstrate their efficiency and accuracy and highlight their potential in shape optimization.

Session 7B

EXTENSION OF OPTIMIZATION CAPABILITIES WITH TOSCA, ANSA AND ULTRASIM™

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KEYWORDS – Optimization, TOSCA, ULTRASIM™, fiber reinforced plastics

ABSTRACT – This presentation gives an insight into the conjoint application of shape optimization and ULTRASIM™ at BASF using ANSA as pre-processing tool.
Thermoplastic materials, especially if they are reinforced with short glass fibers, show some special mechanical properties that differentiate them from metals. There is tension-compression asymmetry, dependency on temperature, humidity (in case of Polyamide) and strain rate, and, depending on the fraction of fiber reinforcement, an increasing anisotropy caused by fiber orientation and orientation distribution. To precisely predict the performance of structural parts made of those materials, those properties have to be taken into account in simulation. As fiber orientation and orientation distribution is a result of the injection molding process, this process has to be simulated and taken into account for subsequent mechanical analyses. Experience shows that the accurate prediction of the part behaviour is not possible with classical methods used for metals.
BASF ULTRASIM™ is a simulation environment that takes the above described properties into account: The fiber distribution obtained by process simulation is taken into account to form a specific material law for every finite element of the structural simulation model. An energy based failure model allows the precise prediction of load level and –location in the part. ULTRASIM™ can be used with many of the established commercial FE-solvers. Data exists for a big range of BASF thermoplastics.
Structural parts often show “load spots”, e.g. in the area of notches, diameter changes and so on. Local shape optimization is an established tool for the reduction of those spots. One of the most common shape optimization software is TOSCA.shape, which uses a homogenization approach.
To be applicable in daily work, advanced methods like ULTRASIM™ and shape optimization have to integrate tightly in standard simulation tools. At BASF, a fast and continuous simulation setup is provided by using ANSA for both standard preprocessing and optimization setup.
The presentation motivates the general problems and challenges and gives examples for first successful use of the ANSA/Tosca/ULTRASIM™ Workflow.

DEVELOPMENT AND USE OF AN ANSA COMPONENT FOR ISIGHT PROCESS INTEGRATION

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KEYWORDS – Process Automation, Multidiscipline, Optimization, Components, Morphing

ABSTRACT – In today's competitive marketplace, successful companies are designing and delivering high quality, robust products while simultaneously reducing their design cycle times. Simulation and process automation software are key enablers that allow these conflicting goals to be managed. Simulation predicts performance while process automation captures the simulation process involving multiple design tools, greatly increasing the number of design alternatives that can be studied. ANSA, a product of BETA CAE Systems, is an advanced multidisciplinary CAE pre-processing tool which is used to prepare a design alternative for simulation. Isight, a product of SIMULIA, enables users to automate simulation process flows and leverage advanced techniques such as Design of Experiments, Optimization, Approximations, and Design for Six Sigma to thoroughly explore the design space. Isight comes equipped with a standard library of components which form the building blocks of Isight process flows. A component is a container with its own interface for integrating and running a particular simulation application directly within Isight. For years, Isight has interacted with ANSA through generic components. We determined that a more specific integration between ANSA and Isight was required in order to make it easier to develop Isight process flows that contain ANSA as one of the steps. This paper describes the development tools used to create the Isight ANSA component. A simulation use case, the design of a piston rod, is described to demonstrate the ANSA component. Common real-world issues are highlighted that the user of such a component must consider in order to be successful with process automation and optimization.

MULTI-OBJECTIVE OPTIMIZATION WITH MODEFRONTIER INTERFACES FOR ANSA AND METAPOST

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KEYWORDS – Multi-objective Optimization, Multi-Variate Analysis, Game Theory, Grid Computing

ABSTRACT – This paper is focused on the integration of multi-objective design environment code modeFRONTIER with ANSA mesh morphing and µetaPOST CAE visualization software.
In this environment, the users can easily define a workflow linking together different modules that represent the 'bricks' of the optimisation problem: design variables, model and mesh files, CAE nodes, specified outputs, as well as optimisation objectives and constraints.
In particular, several CAE tools can be easily integrated in the process through the available direct interface nodes, including ANSA and µetaPOST, allowing the automatic update of morphing parameters and extraction of specified results (related to optimization objectives).
This paper will also illustrate, through some applications of ANSA combined with FEM and CFD solvers, how the Grid capability of modeFRONTIER allows to distribute the simulations on a network of available machines, fully exploiting the available computing resources. Several multi-objective optimization algorithms are available in modeFRONTIER, and in particular, for the applications of this paper it will be illustrated the efficiency of Game Theory and of fast algorithm FMOGAII (based on Genetic Algorithm and Response Surfaces), to obtain the optimal results with the lowest number of design simulations.
In addition, dedicated tools, including Statistical Analysis and Multi-Variate Analysis, can be used in order to help the users analyse the influence of the variables on the objectives, improve the efficiency of the optimisation strategy and select the definitive solution.

UTILIZATION OF MORPHING/SIZING CAPABILITIES TO OPTIMIZE PERFORMANCE OF REINFORCED PLASTIC COMPONENTS TAKING INTO ACCOUNT THE FIBER ORIENTATION EFFECTS

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KEYWORDS – Morphing, Sizing, Optimizing, Fiber, Plastic

ABSTRACT – Static or dynamic simulations of plastic components is a process that requires knowledge of the material behavior which is dependent on many different factors. One of the major advantages of plastic part design is the high degree of flexibility to adjust sectional properties such as wall thickness and shape. This flexibility also increases the complexity of designs which makes analysis predictions quite difficult. The designer/analyst responsible for predicting the response of such a part utilizing a plastic material faces the difficulty of making assessment on the part performance and then quickly make adjustments to improve performance. Analysis predictions are significantly depended on the orientation of fibers whenever a reinforced material is utilized. The dependency of performance to processing and thus fiber orientation effects is highly depended on part properties such as geometry and thickness.

Morphing and automatic sizing of different parts of a design can be utilized in a loop process to quickly yield results that normally require multiple design iterations of a CAD 3D model which require a lot of time to complete. This has a negative impact on cost as well as timing for the completion of the project. The process utilized here can evaluate a large number of design iterations in a relatively short time. Once a satisfactory design is achieved the fiber orientation effects for the particular plastic material are taken into account and the appropriate analysis is performed. Analysis results taking into account the anisotropic behavior of plastic materials yield a very accurate prediction where the failure of the material is taken into account.

Session 8A

USING ANSA FOR AUTOMATED FE-MODELING OF TURBOCHARGER HOUSINGS

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KEYWORDS – turbocharger, batch mesh, scripting, automation, ABAQUS

ABSTRACT – When dealing with models that exist in different variants and furthermore undergo several loadcases there is the strong demand for maximizing the level of automation in the process of creating the respective solver input files without loosing control about the process.
The traditional, manual way of preparing the solver-ready FE model consists of the cleanup and defeaturing of the CAD geometry, followed by surface- and volume-meshing. Finally boundary conditions, loads, contacts and everything else, which makes up the loadcase, have to be set up. Exemplarily for turbocharger housings this complete FE model build up process has been automated by using ANSA's batch mesh and scripting capabilities – starting from the CAD geometry until the loadcase-dependent, ready to run ABAQUS solver input files, which are organized in a user-defined include structure. The process is controlled via an easy to use GUI, giving the user the possibility to control the level of automation and manually intervene at any point.

ANSA BATCH MESHING FOR CAD BASED VEHICLE CONCEPT MODELING

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KEYWORDS –

ABSTRACT – Batch meshing has a high importance in the simulation driven development process. Vehicle variants that are generated based on CAD geometry have to be evaluated with different simulation disciplines and meshes have to be generated for that purpose. Batch meshing allows a high level of process automation and therefore limits the time consuming manual generation of finite element meshes. The capabilities of ANSA to realize a large number of connections using the connection manager complete a powerful automatic meshing procedure.
The Fast Concept Modeler (FCM) is a CATIA V5 integrated software solution for the fast generation of vehicle concept models. The entire process during the concept phase is covered using a uniform geometric model representation from the early phase through to the analytical cycles to the start of production design. In the different phases, a finite element model can be extracted using a close link to the ANSA batch meshing procedure. The attributes for connections can already be defined in the 3D CAD model and are transferred to ANSA using a well-defined interface.
The combination of ANSA and Fast Concept Modeler enables an efficient engineering process using CAD based concept geometries in combination with powerful meshing and realization of different connection types. During the presentation the workflow will be described and is illustrated based on examples.

ANSA AS AN ADVANCED TOOL IN BIOMEDICAL MODELLING AND ENGINEERING

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KEYWORDS – Biomedical modelling, Reverse engineering, Anatomic specific mesh generation

ABSTRACT – 3-D finite element models representing functional parts of the human body have been repeatedly introduced over the last years in order to simulate the biomechanical response of the human musculoskeletal system or investigate trauma related surgical treatment.
The first part of this study introduces ANSA as a Finite Element Analysis (FEA) based tool for the manipulation and segmentation of Computer Tomography (CT) based data, to obtain a geometrically accurate representation of a human skull and lumbar spine segment respectively.
In a second approach a mixed element technique was applied during the mesh generation of the lumbar spine segment, facilitating the construction of compound-elements which allow for the consideration of complex anatomical characteristics, such as the anisotropy of the intervertebral discs. This provided valuable insight on the stress development within the model under multi-axial loading.
The novelty of the introduced model is based on the anatomical specific mesh generation, incorporating anatomic details of the examined tissue during modelling (pre-processor) in contrast to hitherto presented models considering anisotropic material properties solely during the simulation itself (post-processor). This results in smooth stress transitions among the individual model units and superior results' accuracy.

Session 8B

EFFECT OF PLY NUMBER & ORIENTATION OF COMPOSITE STRUCTURE IN BIRD STRIKE ANALYSIS

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KEYWORDS – bird strike, SPH, ANSA, µETA Post-Processor, composite structure, LS- DYNA

ABSTRACT – Recently Birdstrike is very commonly encountered issue taken into account for all the aircrafts engine designs. Considering Birdstrike as a major concern, everyone is concentrating to develop the bird hit proof structure, as an indication composite material is the most suitable one. FE method is very commonly used for analyzing such issues. This is large deformations, high strain rate problem. And the bird material is very soft material and is as good as considering a packet of fluid with high velocity approaching the structure. The fluid modeling in explicit codes like LS-DYNA is very well represented and supported as material model SPH. For modelling ANSA is being used with its robust capabilities for generating SPH elements. In this work, attempt has been made to understand the effect of two factors PLY-Number and PLY-Orientation in laminate of the composite structure.

First by varying PLY-Numbers of laminate the study is being made. In the second stage by changing the PLY-Orientation of laminate, effect on the damage to the structure is being studied and various advantages and disadvantage is being reported using µETA Post-Processor as post processing tool.

EMC MODEL BUILDING USING ANSA

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KEYWORDS – Electromagnetic compatibility, pre-processing, meshing, solver, framework

ABSTRACT – An useful software tool (ANSA-AMELET wrapper) created by Evektor within the HIRF-SE project (FP7 Research Programme of EU) extends the conventional application fields of ANSA to EMC modelling and simulations. The conference contribution will show, how an airplane EM model is built and meshed in the ANSA environment and then converted into the AMELET HDF data structure for EMC simulations by a plenty of useful 3D solvers integrated in the HIRF-SE framework.

CAE MODEL INTERROGATION & DATA MINING

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KEYWORDS – (CAE Post processing, Data Mining, CAE toolset, knowledge elicitation)

ABSTRACT – Current intensive design and development environments emphasise the need for a rapid and higher performing PDP (Product Development Process). In an effort to succeed at such environment, most enterprises utilise extensively virtual tools. Within PDP environment CAE tools are the most effective and efficient means to rapidly qualify and quantify product expectations and deliverables.
This paper focuses on the CAE's post processing stage and utilising a simple generic example (PDP of the frontal bicycle configuration) explains the process of a CAE model interrogation with the view to elicit data into information and knowledge. This is achieved through a detailed graph analysis and affiliation with other interdependent data via 'functional analysis and system design principles'.

Session 10

CRASH SIMULATION: CHALLENGES AND FUTURE PROSPECTS

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KEYWORDS – Crash simulation, crashworthiness, damage and failure, geome discretization, technological discretization.

ABSTRACT – Over the last decades, numerical simulation has evolved into a powerful tool for the design and development of products. Crash simulation was extensively used by the automobile industry for the development of vehicles with regard to their passive safety – known as crashworthiness. In order to asses vehicle's crashworthiness prospectively, engineers shifted their focus on : its deformation patterns (global and local), the acceleration experienced by the vehicle structure during an impact, and the probability of injury predicted by human body models.
In this way the occupant's compartment intrusions, vehicle's deceleration and occupant's HIC values could be accurate predicted.
The rapidly increasing computational resources and the development of reliable and robust simulation software, with the aid of powerful Pre- and Post-processors, open up a new path in the evaluation of structures using two additional variables: damage and failure.
For this, the knowledge of manufacturing and production history is essential. History which can be comprised either with the aid of simulation or the use of adequate high accuracy measurement techniques in experimental procedures.
This presentation, will at first place emphasis on the variation of crash simulation with regard to geometrical and technological discretization. The geometrical discretization implies the grade of description detail and the completeness of the models regarding the “package”. The technological discretization will be exhibited by the experimental acquisition of material data to the point of numerical material model, taking also into consideration the manufacturing process.
Subsequently we shall present you examples for the validation of experiment- and simulation results upon material test specimens, component- and full vehicle tests.

Concluding we shall exhibit

1. the limits of simulation concerning the conclusion efficiency, the expense and the gain, and
2. the perspective for further development of simulation software, including the pre- and post-processors, aiming to the increase of evaluation power.

VEHICLE LEVEL UFEA PROCESS USING ANSA, ABAQUS AND SIMULIA SCENARIO DEFINITION

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KEYWORDS – Vehicle Level Assembly Process, Unified FEA, Abaqus, ANSA, µETA, Scenario Definition

ABSTRACT – Significant challenges confront the automotive industry today, including increasingly stringent fuel economy and emission reduction regulations; stricter crashworthiness and occupant safety legislation; quickly evolving customer preferences; and the ever-increasing market demand for better vehicle performance and reliability.

Simulation can be a key enabler in addressing these challenges; increasing sophistication of simulation software along with continuing gains in high performance computing are making this possible. Robust simulation processes that can be efficiently and repetitively executed are an important factor in achieving the full potential value of simulation. At the full system or full vehicle level, the relevant models are very large and complex; hence assembling the models, executing the simulations, and evaluating simulation results can be somewhat inefficient and error-prone. Incorporating proposed design changes during the vehicle development cycle further complicate the processes.

A workflow has been established using ANSA, Abaqus, and Scenario Definition to efficiently and robustly perform a wide range of performance attribute simulations at the system level. These performance attributes include stiffness, mobility, and crash simulations for targeted models, including body-in-white, body-in-trim, and full vehicle. Scenario Definition is used for overall process and data management and Abaqus is used to execute the performance attribute simulations. The workflow also leverages the capabilities available in ANSA with the use of key features, such as the Generic Entity Builders and Connectors, along with the ANSA Task Manager. With the help of ANSA Task Manager, ANSA Task templates are created, enabling a fast and efficient way to generate run-ready Abaqus input files for the targeted models and simulations. Another important benefit gained from utilizing ANSA Task templates in conjunction with Scenario Definition is that it is then very straightforward to incorporate a proposed design change into the targeted models and subsequently spawn a new series of simulations to determine the impact of the proposed design change. The established workflow also involves the use of µETA for post-processing of the Abaqus results. By using the scripting capability and the built-in Report Composer tool in µETA, customized analysis reports are automatically and efficiently created during the post-processing session for each of the performance attribute simulations.

THE USE OF GENERIC ENTITIES FOR MULTIDISCIPLINARY PREPROCESSING. A SIMPLE BUT POWERFUL PATTERN IN ANSA.

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ABSTRACT – Today's multidisciplinary CAE environment demands for rapid FE Model development cycles, thus the efficient processing of repetitive and complex modeling tasks is vital. This creates a need for highly automated processing steps and effective data sharing between the different CAE disciplines.

BETA CAE Systems SA, in order to meet the above requirement, came up with a series of technologies, integrated within its preprocessor ANSA. These technologies allow the handling of the preprocessing environment in the engineering entities level rather in the solver entities level, making possible the treatment of model data as generic engineering data and not as specific FE solver entities.

For simple tasks, such as the spotweld connection modeling, to more complex ones, such as a seatbelt or that of a stamping result mapping, there are ANSA entities that hold all the engineering data needed for its realization to the respective e.g. LS-DYNA entities. All the different types of those Generic Entities are similar in their definition and realization. At realization time the generalized entities, automatically adapt to the solver-specific FE (e.g. LS-DYNA). Thus making it straightforward to master the ANSA model-build-up capabilities and share and re-use the engineering data among different disciplines.

This technology essentially creates a single, generic, pattern that is re-used throughout ANSA modeling tasks. This pattern driven technology provides a very practical and powerful solution for recurring modeling processes where the engineering data and the solver's data are kept separately, and associated as required.

This paper on ANSA's Generic Entities presents the latest advances in model build-up technologies in the specific areas of connections and connectors, mass trimming, results mapping, dummy positioning and restraining, pedestrian and FMVSS 201U model set-up. As it is demonstrated, the exploitation of this modeling approach makes the LS-DYNA model built up process more time, effort and cost efficient.

Session 11

CAE MODEL BUILD-UP IN COLLABORATION WITH EXTERNAL SUPPLIERS NOT HAVING DIRECT ACCESS TO THE ENTERPRISE SDM ENVIRONMENT

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KEYWORDS – CAE Model build, PLMXML, External Supplier, SDM

ABSTRACT – Real life CAE activities are seldom confined within the walls of an Enterprise. Equally to the people working in the same department, external Suppliers play a key role to the delivery of specific products and to the completion of a CAE workflow. It is therefore necessary to establish a standard way to communicate simulation data to/from a Supplier and to integrate a Supplier's work into the Enterprise SDM environment.
By utilizing an example of a full-vehicle model build-up process (that also includes trim information), this work presents an efficient and versatile approach to the problem of distributing the work to a number of Suppliers situated off-site. Furthermore, it demonstrates how this same approach is used by the in-house engineers to finalize the simulation tasks by interacting directly with the SDM environment. It also considers that Suppliers have no direct access to the main SDM environment, so acquisition of requirements related to the modeling process may be significantly delayed or not delivered at all. These facts impose additional constraints to the integration of the Supplier's deliverables into the enterprise SDM:

- the volume of data communicated to/from the Supplier should be kept at a minimum
- data attributes may be missing or incomplete
- Supplier should start working with the data as soon as possible
- Supplier (or the in-house engineer) would have to populate the correct data attributes at a later stage
- accommodation of data updates should be based on a "delta" approach to minimize the size of the exchanged data
- the applications used by the Supplier are often not under the control of the Enterprise

Siemens PLM Software and BETA CAE Systems S.A. have worked together to develop a methodology that efficiently handles the above use-case, by utilizing the open PLM XML protocol to facilitate the communication of information and data between an Enterprise and its Suppliers.

IMPLEMENTATION AND USE OF SPDRM TO STREAMLINE A CAE PROCESS

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KEYWORDS – Simulation Process, Data and Resources Management

ABSTRACT – Seen in the context of traditional PLM, the growing complexity of simulation and analyses for new products brings CAE engineers in front of a great challenge: to improve CAE productivity and make CAE fast, flexible and efficient in order to identify deficiencies in time and suggest possible ways of improvement. However, information required for downstream CAE processes is often unavailable, untraceable, outdated or susceptive to error-prone manual methods. CAE's value is constrained by bottlenecks at data mining and dissemination. At the same time, CAE suffers from the lack of knowledge capturing and information reusability as the intellectual property gained by the collective experience of best practices is lost.

An approach to address the above is to place the CAE activities within a Simulation Data Management environment. The CAE cycle, however, is by definition a collaborative *process* and covers a wider field than just *data*. It involves individual engineers, departments, suppliers and other hardware/software resources. It is therefore essential that a Simulation Data Management environment is capable of associating the CAE data and the CAE activities with the available resources (human or non-), and place these in the context of a well-defined workflow.

By considering an example of a typical CAE workflow for the evaluation of vehicle performance in various disciplines, this work highlights the importance of orchestrating all CAE workflow actors in a common Simulation Process, Data and Resources Management (SPDRM) environment. Furthermore, this work will utilize the example to showcase the advantages presented when the applications involved in the workflow and the SPDRM environment share the same data repository.

Beyond Sessions

ANSA PRE-PROCESS FOR TTI POWER TOOLS CAE APPLICATION

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KEYWORDS – Geometry Clean-up, Tetra, Map, Batch mesh, Morph, LS-DYNA, Optimize, CFX, Boundary layer, Mid-surface

ABSTRACT – ANSA is a flagship product of BETA CAE Systems, also is one of the best mesh software for CAE molding. We launched it into Power tools CAE analysis, including drop test analysis, strength analysis & design optimization. ANSA also can provide high efficiency pre-processing for CFD applications and other disciplines. Its capabilities meet the current industry needs for external and internal flow simulations, increase productivity and contribute to high quality CFD results. It's a powerful pre-processing tool to power tools CAE simulation.

CALCULATION OF VERTICAL STIFFNESS OF AIR SPRING WITH FEM

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KEYWORDS – Air Spring; Vertical Stiffness; Finite Element Method; ABAQUS; ANSA

ABSTRACT – Finite element method (FEM) was introduced to analyze vertical stiffness of air spring because of traditional method's limitation. Taking a rubber air spring as an example, the preprocess work was done in the ANSA software and then solved in ABAQUS software. According to comparison of results between numerical simulation and experimental method, it shows that the numerical simulation method is feasible and effective for simulating the inflation process of rubber air spring, and calculating the vertical stiffness.

CFD ANALYSIS OF WINDSHIELD HEATER SYSTEM

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Keywords – windshield, finite element method, heat transfer

Abstract – Understanding the heat transfer interaction between inflow fluids and windshield surface is of ramount practical significance. In this paper, the heat transfer process is investigated utilizing a three-dimensional finite element method. Numerical analyses using Ansa and Thesues predict a detailed description of heat transfer. The answer shows the simulation method is feasible and convenient.

OIL PIPE ANALYSIS OF LOW CYCLE FATIGUE AND FRACTURE UNDER RECIPROCATING BENDING LOAD

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KEYWORDS – Oil pipelines; Coiled tube; Low-cycle fatigue; ANSA; ABAQUS

ABSTRACT – Oil pipelines often subjected from the cyclic loading during its services, such as bending loading. So it is very significant for the oil pipe to carry out the fatigue life prediction under the reciprocating bending load and to investigate the damage and fracture in different cycle times by using of numerical analysis in the fields of oil and chemical industry. Low- cycle fatigue analysis using the direct cyclic approach was implemented in two different FEM models whether to consider the inner pressure in the pipe or not. The result indicated that there are almost the same cycle times, damage state and fracture morphology for the analysis and the experiments.

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